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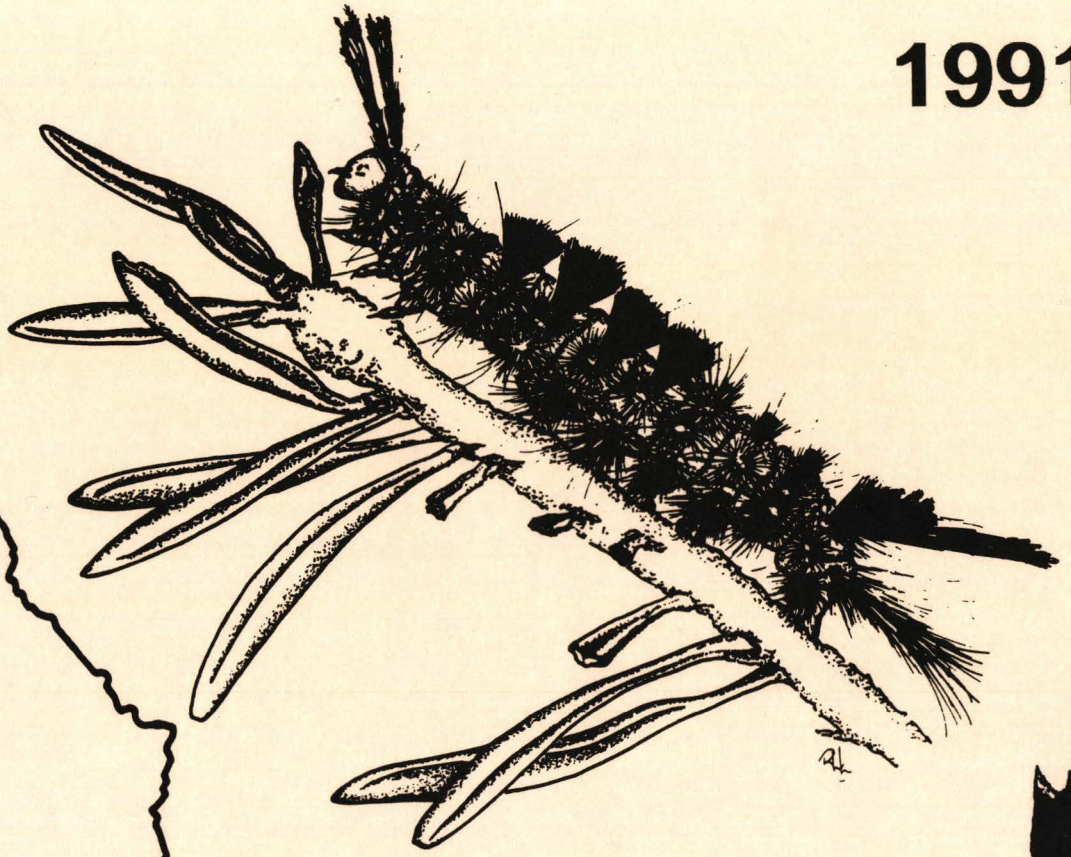
IDAHO FOREST PEST CONDITIONS & PROGRAM SUMMARY

1991



IDAHO DEPARTMENT OF LANDS

USDA FOREST SERVICE
NORTHERN AND INTERMOUNTAIN
REGIONS

Report No. 92-1

IDAHO FOREST PEST CONDITIONS AND PROGRAM SUMMARY

1991

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INTRODUCTION

This report summarizes major insect and disease damage on forested lands of all ownerships within the State of Idaho for 1991. Much of the information for this report was derived from aerial and ground surveys and associated detection and evaluation activities by pest management personnel within the USDA Forest Service and the Idaho Department of Lands. This report also describes several aspects of the pest management program for each of the agencies.

Losses outlined in tables are only estimates. Likewise, maps outlining areas of major insect infestation provide general locations of problems.

CONDITIONS IN BRIEF

FOREST INSECTS

Mountain pine beetle activity increased during 1991, but remains at comparatively low levels. Approximately 40,000 dying trees were detected this year compared to 11,300 trees in 1990. Pine engraver populations remain at endemic levels in northern Idaho. Western pine beetle once again decreased markedly from 65,300 trees in 1990, to only 13,500 trees in 1991. Douglas-fir beetle activity decreased state wide, from almost 200,000 trees in 1990 to 93,800 trees in 1991. Fir engraver populations declined significantly in northern Idaho. In southern Idaho, fir engraver populations also decreased from 101,000 trees in 1990 to approximately 27,500 trees in 1991. There was a massive increase in western balsam bark beetle activity in southern Idaho and a slight increase in northern Idaho also. Spruce beetle activity increased only slightly in northern Idaho, but there was a significant reduction in southern Idaho, mostly on the Payette National Forest.

Defoliation by the western spruce budworm increased slightly state wide, with the largest infestation located on the Salmon National Forest in southern Idaho covering approximately 46,200 acres. In southern Idaho, 312,000 acres of Douglas-fir tussock moth defoliation were detected. This is the largest amount of tussock moth caused defoliation ever recorded in that area. There was no visible tussock moth defoliation found in northern Idaho in 1991. A total of 4 gypsy moths were caught in the state, one each in Pinehurst, Moscow, Wendell and Rigby. The balsam woolly adelgid had a significant decrease in total population, but tree mortality has continued.

FOREST DISEASES

Root diseases, white pine blister rust, dwarf mistletoes, and nursery diseases continue to cause serious problems throughout much of the state. Although impacts may be quite severe, the aerial surveys which provide most of the data for this report do not usually record these diseases. Since disease mortality is not usually as apparent as insect outbreaks or forest fires, the extent of losses from diseases may not be fully realized.

We are currently involved in many projects to help managers deal with diseases, and brief summaries of these projects are included in this report.

FOREST INSECTS

BARK BEETLES

MOUNTAIN PINE BEETLE

In northern Idaho, total mountain pine beetle infested areas for all hosts increased from 800 acres in 1990 to more than 3,200 in 1991. Trees killed were estimated at just over 9,200 (Table 1a and 1b, Figure 1). The major lodgepole pine stands affected were in the Craig Mountains where nearly 1,800 trees were killed, on the Nez Perce National Forest (NF) where 1,700 trees were killed, and on the Idaho Panhandle NF's where over 1,000 trees were killed by the beetle. Ground surveys conducted on the Bonners Ferry Ranger District (RD) of the Idaho Panhandle NF's showed an average of 6.6 trees per acre killed in 1991 compared to 11.1 in 1990. Although fewer trees were killed this year, many stands are of the right size and age to indicate a high hazard to the mountain pine beetle.

Other host species were also affected by the mountain pine beetle. Ponderosa pine stands in the Craig Mountains were most severely affected with over 3,000 trees killed on 660 acres. Scattered mortality occurred in white pine--mostly on the Idaho Panhandle NF's. High elevation white bark pine stands on the Nez Perce NF exhibited mortality on 90 acres with over 200 trees killed.

In southern Idaho, 30,400 fading trees were observed. In the largest infestation, located on the Sawtooth National Recreation Area, 12,000 trees were killed; elsewhere increases in mortality occurred on the Boise, Challis, Payette and Targhee NF's, while decreases in mortality occurred on the Salmon NF (Table 1c).

PINE ENGRAVER

Pine engraver populations declined to endemic status in northern Idaho in 1991 (Table 1a and 1b, Figure 1). Only 80 dead ponderosa pine on 15 acres were attributed to the pine engraver beetle. This insect often associated with western pine beetle and jeffrey pine beetle, occurred throughout southern Idaho (Table 1c, Figure 1).

WESTERN PINE BEETLE

Western pine beetle populations, and affected ponderosa pine stands, once again decreased markedly in 1991 in northern Idaho (Table 1a and 1b, Figure 1). In 1990, more than 9,900 acres were infested. That declined to fewer than 2,000 acres in 1991. Slightly more than 6,400 trees were recorded as having been killed by the beetle this past year compared to more than 46,000 the previous year. Most mortality was observed in relatively small, scattered five- to ten-tree groups although 50- to 100- tree groups can still be found in some areas, particularly on the east side of Coeur d'Alene Lake.

In southern Idaho, the western pine beetle's population continued to collapse on the Boise and Payette NF's with approximately 8,200 dying second growth ponderosa pine trees detected in 1991 compared to 23,800 trees in 1990 and 53,200 in 1989 (Table 1c, Figure 1). Ips beetle attacks were frequently intermixed with western pine beetle activity.

Table 1a. Idaho Statewide summary; annual bark beetle mortality by reporting area: **North Idaho**

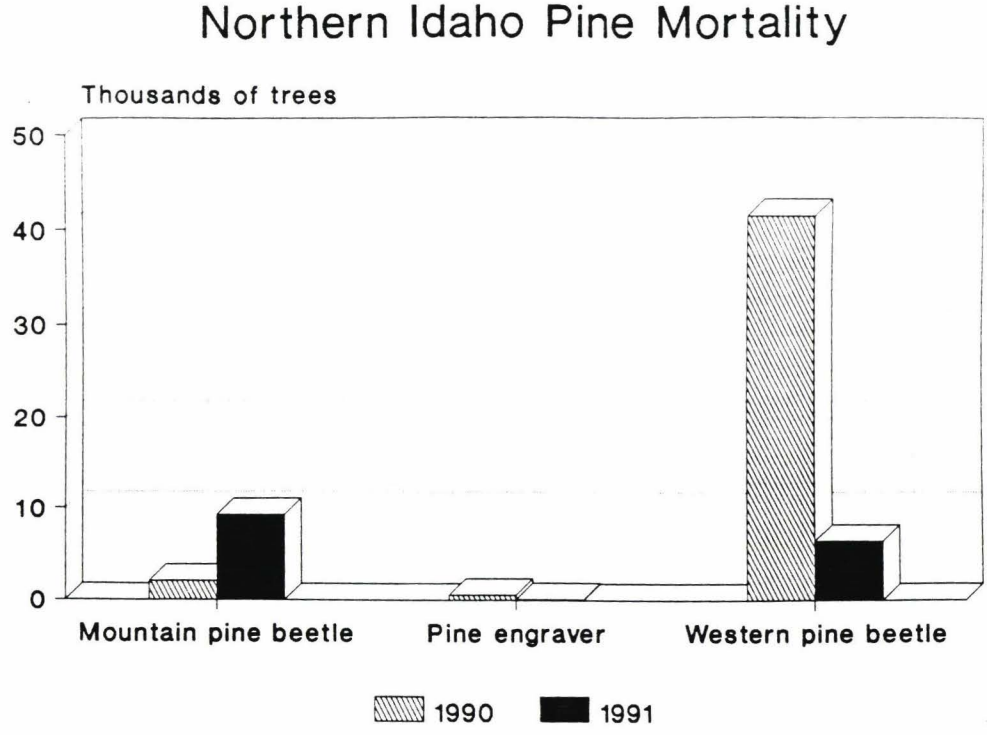
		--Mountain Pine Beetle-- Estimated Mortality			--Pine Engraver-- Estimated Mortality			--Western Pine Beetle-- Estimated Mortality		
AREA	Year	Acres Infested	Trees	MBM Volume	Acres Infested	Trees	MBM Volume	Acres Infested	Trees	MBM Volume
Bitterroot	1991	73	152	13.7	0	0	0.0	34	21	8.4
	1990	0	0	0.0	0	0	0.0	0	0	0.0
Cataldo	1991	32	92	8.9	0	0	0.0	24	43	17.2
	1990	37	95	8.5	0	0	0.0	4	25	10.0
Clearwater	1991	31	44	6.4	0	0	0.0	30	97	38.8
	1990	10	11	3.1	0	0	0.0	28	205	82.0
CPTPA	1991	0	0	0.0	0	0	0.0	34	170	68.0
	1990	130	175	14.8	0	0	0.0	518	2,920	1,168.0
Craig Mtns.	1991	1,038	5,057	422.1	11	70	1.8	172	1,029	411.6
	1990	16	105	9.4	5	90	2.3	2,059	7,875	3,114.0
IPNFs	1991	438	1,263	153.0	2	5	0.1	132	243	97.2
	1990	147	352	43.4	268	250	6.3	342	897	358.8
Kendrick	1991	6	40	3.5	0	0	0.0	204	890	356.0
	1990	0	0	0.0	0	0	0.0	897	4,725	1,890.0

Table 1b. Idaho Statewide summary; annual bark beetle mortality by reporting area: **North Idaho, cont.**

		--Mountain Pine Beetle-- Estimated Mortality			--Pine Engraver-- Estimated Mortality			--Western Pine Beetle-- Estimated Mortality		
AREA	Year	Acres Infested	Trees	MBM Volume	Acres Infested	Trees	MBM Volume	Acres Infested	Trees	MBM Volume
Maggie Creek	**1991**	4	20	1.6	0	0	0.0	78	287	114.8
	1990	154	250	22.5	0	0	0.0	1,133	16,331	6,532.4
Mica	**1991**	154	404	32.4	0	0	0.0	615	1,756	702.4
	1990	0	0	0.0	0	0	0.0	1,453	3,777	1,510.8
Nez Perce NF	**1991**	1,434	1,962	165.1	0	0	0.0	374	560	224.0
	1990	280	1,095	99.4	41	210	5.3	661	978	391.2
Pend Oreille	**1991**	50	189	16.0	0	0	0.0	46	154	61.6
	1990	4	7	0.6	0	0	0.0	118	590	236.0
Priest Lake	**1991**	0	0	0.0	0	0	0.0	18	42	16.8
	1990	0	0	0.0	0	0	0.0	2	10	4.0
West St. Joe	**1991**	10	30	2.6	2	5	0.1	159	849	339.6
	1990	0	0	0.0	0	0	0.0	1,546	3,205	1,282.0
North Idaho Totals	**1991**	**3,272**	**9,263**	**818.7**	**15**	**80**	**2.0**	**1,994**	**6,411**	**2,564.4**
	1990	778	2,090	201.7	314	550	13.9	8,761	41,448	16,579.2

Table 1c. Idaho Statewide summary; annual bark beetle mortality by reporting area: **South Idaho**

		--Mountain Pine Beetle-- Estimated Mortality			--Pine Engraver-- Estimated Mortality			--Western Pine Beetle-- Estimated Mortality		
AREA	Year	Acres Infested	Trees	MBM Volume	Acres Infested	Trees	MBM Volume	Acres Infested	Trees	MBM Volume
Boise	**1991**	3,000	6,000	386.4	740	720	7.2	6,660	6,480	3,564.0
	1990	400	445	28.5	0	0	0.0	25,460	18,150	9,982.5
Caribou	**1991**	200	200	12.6	0	0	0.0	0	0	0.0
	1990	0	0	0.0	0	0	0.0	0	0	0.0
Challis	**1991**	3,200	5,500	345.4	0	0	0.0	0	0	0.0
	1990	3,660	2,320	148.5	0	0	0.0	0	0	0.0
Payette	**1991**	1,700	1,800	113.0	210	100	1.0	1,890	900	495.0
	1990	0	0	0.0	0	0	0.0	14,720	5,680	3,124.0
Salmon	**1991**	100	200	12.6	0	0	0.0	0	0	0.0
	1990	1,420	1,360	87.0	0	0	0.0	0	0	0.0
Sawtooth	**1991**	9,600	15,000	942.0	0	0	0.0	0	0	0.0
	1990	2,730	5,070	324.5	0	0	0.0	0	0	0.0
Targhee	**1991**	1,400	1,700	106.8	0	0	0.0	0	0	0.0
	1990	0	0	0.0	0	0	0.0	0	0	0.0
South Idaho	**1991**	**19,200**	**30,400**	**1,900.8**	**950**	**820**	**8.2**	**8,550**	**7,380**	**4,059.0**
	1990	8,210	9,195	588.5	0	0	0.0	40,180	23,830	13,106.5
State Totals	**1991**	**22,470**	**39,653**	**2719.5**	**965**	**900**	**10.2**	**10,470**	**13,521**	**6,515.4**
	1990	8,988	11,285	790.2	314	550	13.9	48,941	65,278	29,685.7



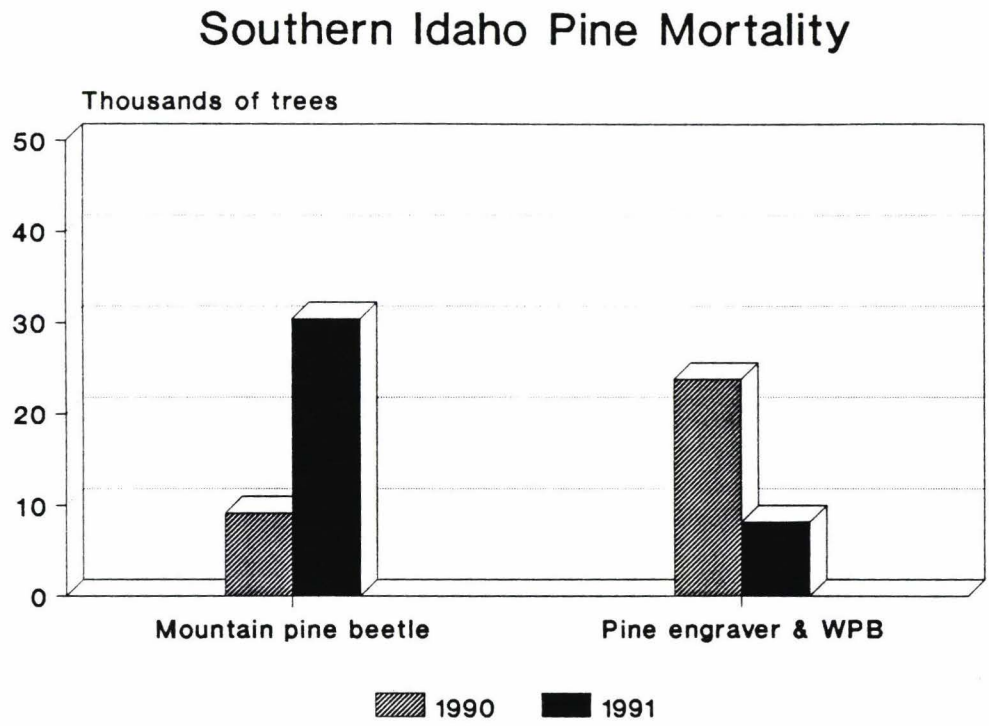


Figure 1. Northern and Southern Idaho Pine Mortality by Bark Beetle Species 1990 - 1991

DOUGLAS-FIR BEETLE

In northern Idaho, the area infested by Douglas-fir beetle declined markedly, from more than 8,000 acres in 1990 to slightly more than 5,300 in 1991. An estimated 12,000 trees (nearly 4.2 MMBF) were killed (Table 2a and 2b, Figure 2).

The Nez Perce NF contained the most beetle activity with over 1,300 acres infested. That was down from over 2,000 acres in 1990. Ground surveys conducted there in 1991 show a rapidly declining population. Activity on the Idaho Panhandle NF's decreased from 3,600 acres in 1990 to 850 in 1991. Ground surveys conducted near Wallace show a static trend while those near Avery predict a declining population. Infested area on the Clearwater NF declined slightly from over 900 acres to 750. Ground surveys there show a static population trend.

On the Caribou NF, Douglas-fir beetle tree mortality plummeted with 2,400 trees killed in 1991 compared to 42,600 trees in 1990. On the Boise NF tree mortality decreased from 62,400 trees in 1990 to 27,900 trees in 1991 (Table 2c, Figure 2). Elsewhere in southern Idaho, mortality caused by Douglas-fir beetle decreased on the Challis, Payette and Salmon NF's, but increased on the Targhee NF in eastern Idaho.

FIR ENGRAVER

Responding to nearly normal precipitation for the third consecutive year in northern Idaho, fir engraver beetle populations declined significantly again in 1991 (Table 2a and 2b, Figure 2). In 1990, more than 36,000 acres had been infested and an estimated 53,000 trees had been killed. Corresponding figures for 1991 indicate 14,700 host trees were recorded as having been killed by fir engraver on 5,600 acres.

Most of the mortality occurred in the Craig Mountains where over 6,000 trees were killed on 2,500 acres. On the Nez Perce NF over 1,000 acres were infested with an estimated 2,400 trees killed. Other areas show declining populations and scattered mortality.

In southern Idaho, 12,700 trees were killed with increasing mortality noted on the Payette NF and decreasing mortality noted on the Boise NF (Table 2c, Figure 2).

WESTERN BALSAM BARK BEETLE

In northern Idaho, only small groups of subalpine fir mortality attributed to the western balsam bark beetle were recorded in 1991 (Table 2a and 2b, Figure 2). Fewer than 900 trees on slightly more than 200 acres were detected.

Massive increases in western balsam bark beetle activity occurred in southern Idaho (Table 2c, Figure 2). In southeastern Idaho, the large outbreaks are located on the Caribou, Sawtooth and Targhee NF's while smaller infestations occur on the Boise, Challis, Salmon and Payette NF's.

Table 2a. Idaho Statewide summary; annual bark beetle mortality by reporting area: **North Idaho**

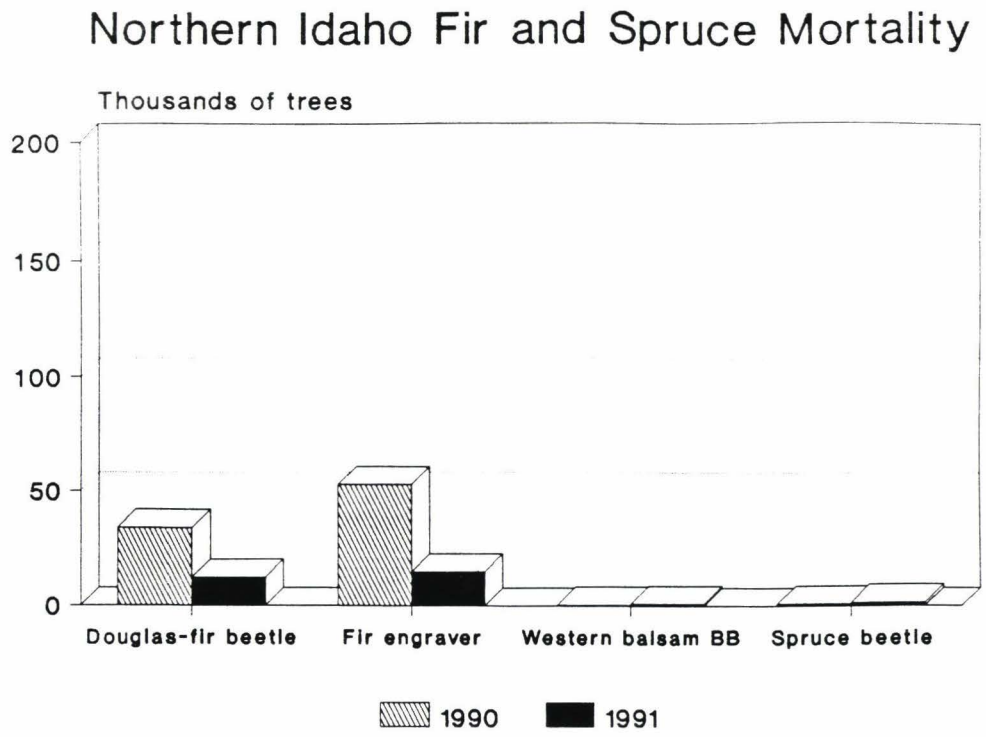
		–DOUGLAS-FIR BEETLE– ESTIMATED MORTALITY			–SPRUCE BEETLE– ESTIMATED MORTALITY			–FIR ENGRAVER– ESTIMATED MORTALITY			–WESTERN BALSAM– BARK BEETLE ESTIMATED MORTALITY		
AREA	Year	Acres Infested	Trees	MBM Volume	Acres Infested	Trees	MBM Volume	Acres Infested	Trees	MBM Volume	Acres Infested	Trees	MBM Volume
Bitterroot	1991	1960	1815	635.3	0	0	0.0	6	12	2.4	18	64	7.0
	1990	0	0	0.0	0	0	0.0	0	0	0.0	0	0	0.0
Cataldo	1991	34	99	34.6	0	0	0.0	41	137	27.4	2	10	1.1
	1990	111	495	173.3	0	0	0.0	78	387	77.4	0	0	0.0
Clearwater	1991	746	2,919	1,021.6	7	9	3.6	360	982	196.4	1	2	0.2
	1990	966	5,075	1,776.3	4	6	2.4	257	825	165.0	0	0	0.0
CPTPA	1991	136	481	168.3	0	0	0.0	214	679	135.8	2	10	1.1
	1990	897	4,741	1,659.3	0	0	0.0	10,660	13,883	2,776.6	0	0	0.0
Craig Mtns.	1991	52	210	73.5	0	0	0.0	2,485	6,542	1,308.4	0	0	0.0
	1990	14	105	36.8	0	0	0.0	17,466	15,883	3,176.6	0	0	0.0
IPNFs	1991	847	2,666	933.1	8	8	3.2	290	463	92.6	57	177	19.5
	1990	3,584	15,089	5,281.1	2	1	0.4	1,277	3,760	752.0	0	0	0.0
Kendricks	1991	26	65	22.8	0	0	0.0	609	1,875	375.0	0	0	0.0
	1990	104	460	161.0	0	0	0.0	709	3,723	744.6	0	0	0.0

Table 2b. Idaho Statewide summary; annual bark beetle mortality by reporting area: **North Idaho**

		–DOUGLAS-FIR BEETLE– ESTIMATED MORTALITY			–SPRUCE BEETLE– ESTIMATED MORTALITY			–FIR ENGRAVER– ESTIMATED MORTALITY			–WESTERN BALSAM– BARK BEETLE ESTIMATED MORTALITY		
AREA	Year	Acres Infested	Trees	MBM Volume	Acres Infested	Trees	MBM Volume	Acres Infested	Trees	MBM Volume	Acres Infested	Trees	MBM Volume
Maggie Creek	1991	38	120	42.0	0	0	0.0	87	338	67.6	0	0	0.0
	1990	92	407	142.4	0	0	0.0	642	2,601	520.2	0	0	0.0
Mica	1991	29	105	36.8	0	0	0.0	178	405	81.0	0	0	0.0
	1990	52	159	55.6	0	0	0.0	791	2,150	430.0	0	0	0.0
Nez Perce	1991	1,368	3,580	1,253.0	1,171	1,514	605.6	1,089	2,343	468.6	8	20	2.2
	1990	2,043	6,539	2,288.6	585	795	318.0	3,190	4,681	936.2	63	130	14.3
Pend Oreille	1991	40	104	36.4	0	0	0.0	16	53	10.6	2	25	2.8
	1990	35	165	57.7	0	0	0.0	598	508	101.6	0	0	0.0
Priest Lake	1991	10	33	11.5	0	0	0.0	0	0	0.0	118	520	57.2
	1990	58	260	91.0	0	0	0.0	24	110	22.0	54	195	21.4
West St. Joe	1991	42	125	33.8	0	0	0.0	254	925	185.0	0	0	0.0
	1990	95	480	168.0	0	0	0.0	896	4,068	813.6	0	0	0.0
North Idaho Totals	**1991**	**5,328**	**12,322**	**4,302.7**	**1,186**	**1,531**	**612.4**	**5,629**	**14,754**	**2,950.8**	**208**	**828**	**91.1**
	1990	8,051	33,975	11,891.1	591	802	320.8	36,594	52,629	10,525.8	117	325	35.7

Table 2c. Idaho Statewide summary; annual bark beetle mortality by reporting area: **South Idaho**

		–DOUGLAS-FIR BEETLE– ESTIMATED MORTALITY			–SPRUCE BEETLE– ESTIMATED MORTALITY			–FIR ENGRAVER– ESTIMATED MORTALITY			–WESTERN BALSAM– BARK BEETLE ESTIMATED MORTALITY		
AREA	Year	Acres Infested	Trees	MBM Volume	Acres Infested	Trees	MBM Volume	Acres Infested	Trees	MBM Volume	Acres Infested	Trees	MBM Volume
Boise	1991	26,500	27,900	3,961.8	0	0	0.0	13,300	7,600	1,444.0	9,000	6,200	682.0
	1990	59,400	62,415	8,862.9	100	40	19.1	73,450	30,690	5,831.1	0	0	0.0
Caribou	1991	1,900	2,400	340.8	0	0	0.0	0	0	0.0	39,900	52,500	5,775.0
	1990	31,020	41,960	5,958.3	0	0	0.0	0	0	0.0	22,970	35,850	3,943.5
Challis	1991	800	1,000	142.0	0	0	0.0	0	0	0.0	300	400	44.0
	1990	6,350	6,615	939.3	0	0	0.0	0	0	0.0	0	0	0.0
Payette	1991	19,200	16,000	2,272.0	36,100	23,800	11,376.4	5,100	5,100	969.0	0	0	0.0
	1990	27,115	18,535	2,632.0	152,810	185,400	88,649.9		16,801	3,192.2	0	0	0.0
Salmon	1991	7,300	7,600	1,079.2	0	0	0.0	0	0	0.0	700	700	77.0
	1990	9,060	11,095	1,575.5	0	0	0.0	0	0	0.0	0	0	0.0
Sawtooth	1991	8,200	10,200	1,448.4	0	0	0.0	0	0	0.0	17,200	17,700	1,947.0
	1990	9,630	12,505	1,775.7	0	0	0.0	1,120	830	157.7	0	0	0.0
Targhee	1991	13,800	15,300	2,172.6	0	0	0.0	0	0	0.0	19,800	40,600	4,466.0
	1990	7,240	11,590	1,645.8	0	0	0.0	0	0	0.0	13,110	24,085	2,649.3
South Idaho Totals	**1991**	77,700	80,400	11,416.8	36,100	23,800	11,376.4	18,400	12,700	2,413.0	86,900	118,100	12,991.0
	1990	149,815	164,715	23,389.5	152,910	185,500	88,669.0	74,570	48,321	9,181.0	36,080	59,935	6,592.8
State Totals	**1991**	**83,028**	**92,722**	**15,719.5**	**37,286**	**25,331**	**11,988.8**	**24,029**	**27,454**	**5,363.8**	**87,108**	118,928	**13,082.1**
	1990	157,866	198,690	35,280.6	153,501	186,302	88,989.8	111,164	100,950	19,706.8	36,197	60,260	6,628.5



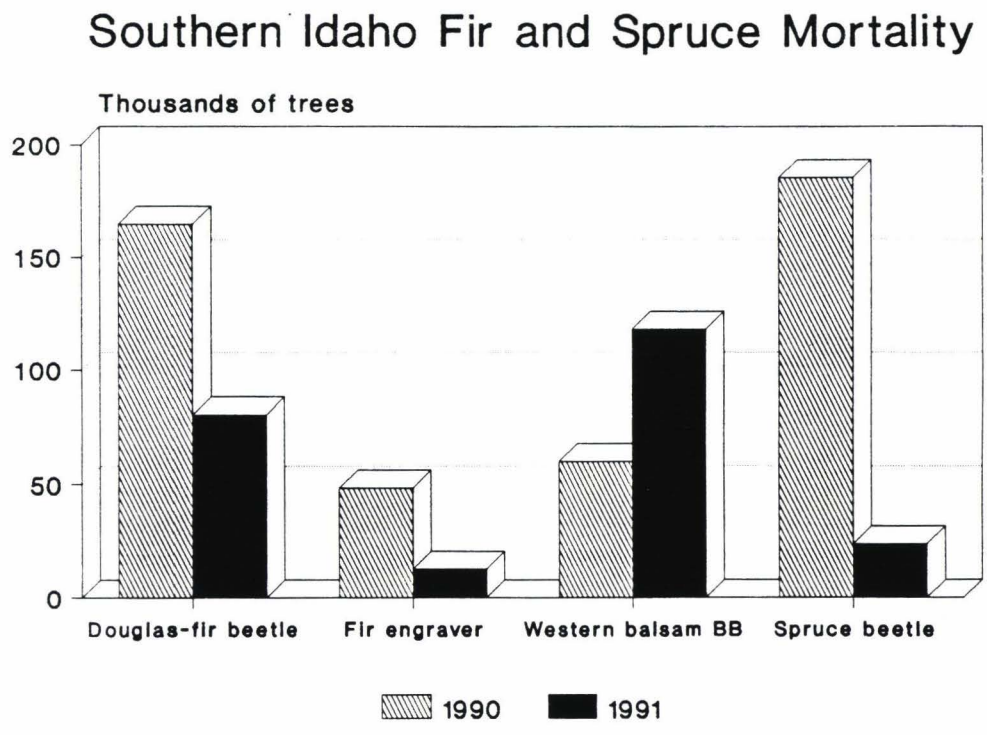


Figure 2. Northern and Southern Idaho
Fir and Spruce Mortality
by Bark Beetle Species 1990 - 1991

SPRUCE BEETLE

Spruce beetle infested areas increased in northern Idaho on the Nez Perce NF (Table 2b, Figure 2). Engelmann spruce stands there are still drier than normal and are experiencing population increases associated with outbreaks to the south, on the Payette NF. The infested area increased from 591 acres in 1990 to almost 1,200 acres in 1991. Just over 1,500 trees were killed.

In southern Idaho, the spruce beetle activity decreased from 185,500 trees killed in 1990 to 23,800 trees killed in 1991 (Table 2c, Figure 2). Most of this decline in mortality occurred on the Payette NF, the only Forest in southern Idaho, with significant spruce beetle activity. Spruce beetle mortality trends from 1985 to 1991 are shown in Table 3.

Table 3. Estimated Spruce beetle caused mortality, 1985 - 1991

		ESTIMATED MORTALITY		
Forest and adjacent lands	YEAR	Acres Infested	Trees	MBM Volume
Boise	1985	55	84	33.6
	1986	--	1,095	438.0
	1987	607	669	319.8
	1988	155	254	121.4
	1989	175	227	108.5
	1990	100	40	19.1
	1991	0	0	0.0
Payette	1985	3,881	13,775	5,510.0
	1986	--	12,600	5,040.0
	1987	13,002	15,873	7,587.3
	1988	36,364	44,756	21,393.4
	1989	26,451	32,108	15,347.6
	1990	152,810	185,460	88,649.9
	1991	36,100	23,800	11,376.4
Totals	1985-1991	269,700	330,741	154,904.6

SILVER FIR BEETLE

Large populations of this beetle were found overwintering in root collars of grand fir trees, from Smith's Ferry to McCall, Idaho. Infestation did not cause tree mortality.

DEFOLIATORS

DOUGLAS-FIR TUSSOCK MOTH

No visible defoliation due to the Douglas-fir tussock moth has been found in forested areas of northern Idaho since 1986. Pheromone trapping detection surveys were conducted and trap counts were in general, still very low (Table 5a). In the Coeur d'Alene Mountain area, trap catches that were high in 1990, decreased to a very low level in 1991. Larval sampling was conducted at several sites as part of the early warning system. Larval populations from lower crown sampling were very low at most sample sites also.

In southern Idaho, 312,000 acres of defoliation were recorded (Table 4a) on the Boise, Payette, and Sawtooth NF's. Additionally, on Bureau of Land Management and state lands east of Bellevue, and in the Owyhee Mountains south of Boise considerable defoliation was mapped.

The largest infestation is located on the Boise NF and contiguous areas of the Sawtooth NF where primarily Douglas-fir is infested. Elsewhere on the Boise NF grand fir, over extensive areas on the Emmett RD, was visibly defoliated. Visible defoliation was not observed on Bald Mountain near Sun Valley, however ground surveys confirm the presence of higher than normal populations of the insect. On the Payette NF 18,500 acres of Douglas-fir and grand fir were defoliated (Table 4a) in a unique infestation consisting of both Douglas-fir tussock moth and western spruce budworm. High numbers of egg masses were found on state and private lands in the Packer John Mountain area south east of Smiths Ferry. Visible defoliation was extremely light and only found at a few sites. High numbers of egg masses were found on state and private lands in the Packer John Moumtain area, southeast of Smith Ferry. No visible defoliation was seen.

WESTERN SPRUCE BUDWORM

In northern Idaho, acres of defoliation on the Salmon River RD, Nez Perce NF more than doubled since 1990 to over 12,000 acres in 1991 (Table 4b, Figure 3). The majority of these acres were classified as "light" defoliation. Egg mass sampling on 16 plots revealed an average of 4.42 egg masses per square meter of foliage, an increase from 1.74 in 1990. Defoliation is expected to increase in 1992.

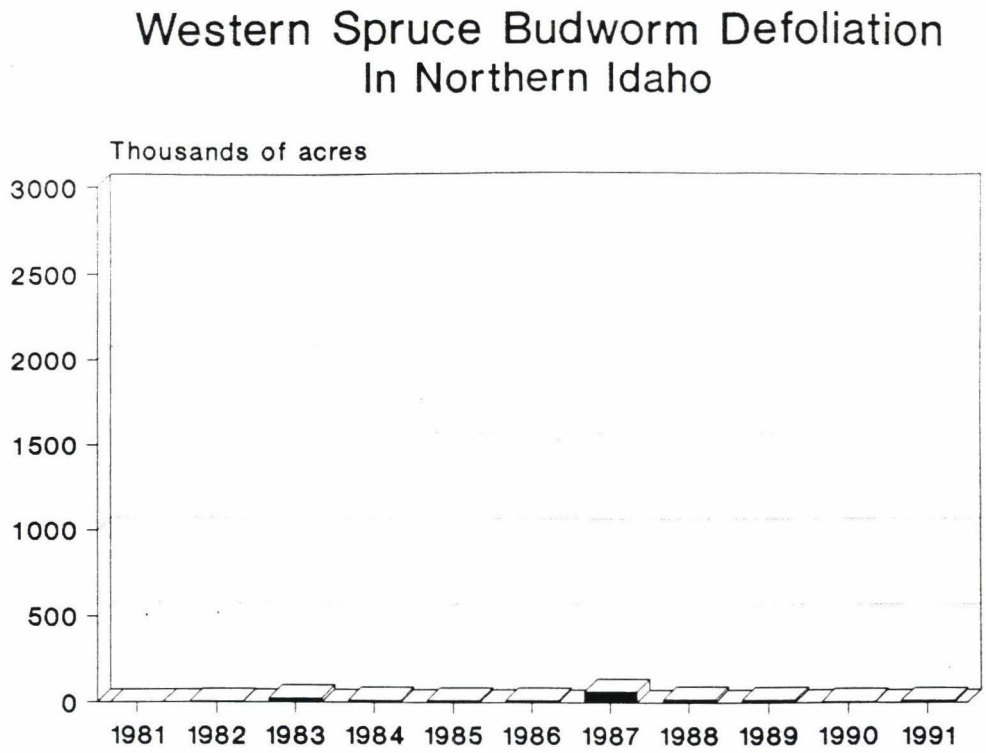
In southern Idaho, defoliation of Douglas-fir and true fir by western spruce budworm remained relatively static with 49,300 acres visibly defoliated during 1991 compared to 42,900 acres in 1990 (Table 4b, Figure 3). The largest infestation, located on the Salmon NF, covers 46,200 acres. Elsewhere, 2,200 and 900 acres of defoliation were recorded on the Challis and Targhee NF's, respectively. Defoliation intensity was classified as mostly light.

Table 4a. Acres of DOUGLAS-FIR TUSSOCK MOTH defoliation as determined by aerial surveys

		Defoliation Intensity				
Forest and adjacent lands	Year	Light	Moderate	Heavy	Total	Change
Boise	1991 1990	59,629 10,700	47,080 8,500	102,628 17,600	209,337 36,800	+172,537
Payette	1991 1990	679 11,000	970 0	16,771 0	18,420 11,000	+7,420
Sawtooth	1991 1990	14,840 1,300	16,234 800	38,183 0	69,257 2,100	+67,157
Owyhee Mtns.	1991 1990	0 800	0 0	15,000 0	15,000 800	+14,200
Total	1991 1990	75,148 23,800	64,284 9,300	172,582 17,600	312,014 50,700	+261,314

Table 4b. Acres of WESTERN SPRUCE BUDWORM defoliation as determined by aerial surveys.

		Defoliation Intensity				
Forest and adjacent lands	Year	Light	Moderate	Heavy	Total	Change
Challis	1991 1990	2,200 314	0 441	0 0	2,200 755	+1,445
Nez Perce	1991 1990	11,127 3,856	1,072 1,517	0 0	12,199 5,373	+6,826
Salmon	1991 1990	44,300 36,149	1,900 4,384	0 1,304	46,200 41,837	+4,336
Targhee	1991 1990	900 0	0 0	0 0	900 0	+900
Total	1991 1990	58,527 40,319	2,972 6,342	0 1,304	61,499 47,965	+13,534



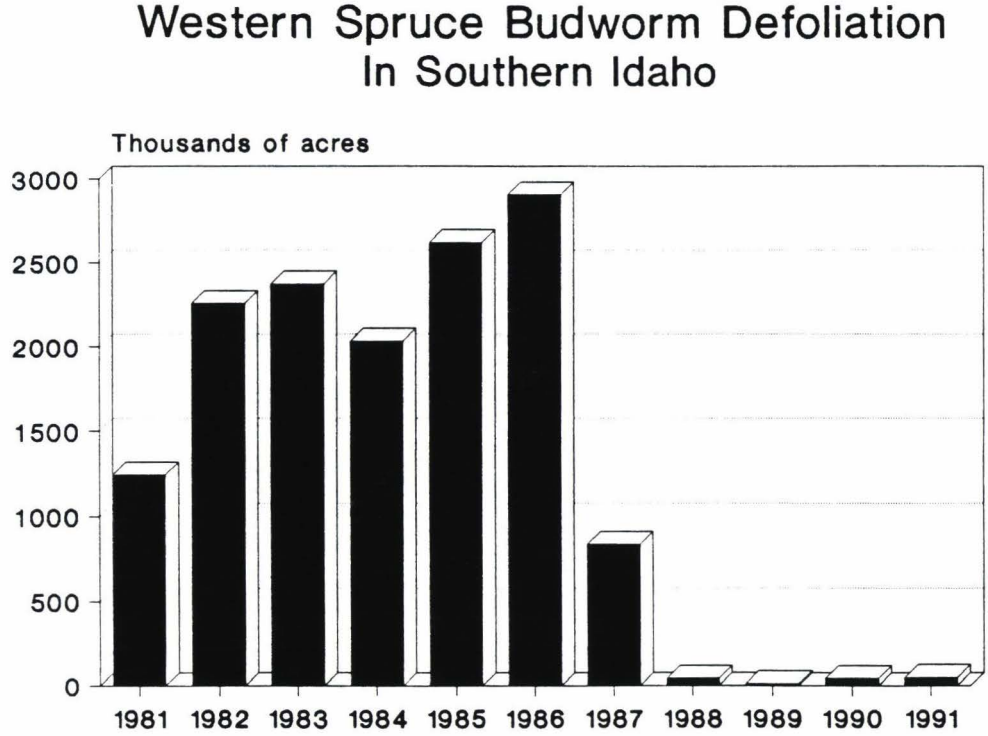


Figure 3. Acres of Western Spruce Budworm as Determined by Aerial Surveys in Northern and Southern Idaho 1981 - 1991

Table 5a. Means of average moth catch per 5 pheromone trap/sample plots in Idaho, 1991-1981

AREA	Number of 1991 sample plots	1991	1990	1989	1988	1987	1986	1985	1984	1983	1982	1981
STATE AND PRIVATE												
Coeur d'Alene	5	0.0	*	*	*	*	*	*	*	*	*	*
Coeur d'Alene	5	0.12	7.2	0.0	0.0	0.24	8.1	9.2	4.7	3.6	1.5	0.0
Plummer-Moscow	13	0.14	0.03	0.0	0.02	1.28	25.6	59.9	18.8	13.8	9.3	0.9
Plummer-Moscow	10	0.08	0.06	0.0	0.0	0.32	15.2	43.3	7.0	3.3	2.5	*
Plummer-Moscow	3	0.0	0.13	0.0	0.0	0.49	14.6	32.6	9.0	4.3	*	*
Plummer-Moscow	1	0.0	0.0	0.0	0.0	1.0	42.8	68.4	36.4	*	*	*
Plummer-Moscow	1	0.0	0.0	0.0	0.0	3.8	49.7	76.0	*	*	*	*
Plummer-Moscow	2	0.1	0.1	0.0	0.2	9.0	80.5	*	*	*	*	*
Plummer-Moscow	15	0.05	0.18	0.0	0.02	2.17	*	*	*	*	*	*
Craig Mountain	8	0.0	0.2	0.0	0.0	0.1	3.5	0.4	0.6	0.5	0.5	2.7
NEZ PERCE NF												
Selway RD	5	0.0	0.4	0.05	0.2	0.0	0.1	0.0	0.05	0.05	0.6	1.2
Slate Creek RD	5	2.5	0.1	0.0	0.0	0.0	0.9	0.3	0.7	1.9	2.1	1.6
CLEARWATER NF												
Lochsa RD	2	1.2	0.0	0.2	0.0	0.0	0.3	0.0	0.0	0.0	0.2	3.6
Canyon RD	5	0.3	0.2	0.0	0.0	0.0	1.7	0.9	*	*	7.4	2.2
Pierce RD	5	0.6	0.3	0.0	0.1	0.1	4.0	0.6	0.1	0.1	3.0	3.6

* indicates no traps were deployed

Table 5b. Means of average moth catch per 5 pheromone trap/sample plots in Idaho, 1991-1981, cont.

AREA	Number of 1991 sample plots	1991	1990	1989	1988	1987	1986	1985	1984	1983	1982	1981
BOISE NF												
Mountain Home RD	4	68.9	5.3	0.2	0.6	1.4	1.2	0.0	0.4	21.7	0.3	*
Boise RD	5	59.6	65.6	*	*	*	*	*	*	*	*	*
Idaho City RD	6	27.2	*	*	*	*	*	*	*	*	*	*
Cascade RD	3	0.7	31.6	0.0	0.2	0.2	1.2	1.0	0.0	20.0	0.3	0.1
Lowman RD	5	20.0	*	*	*	*	*	*	*	*	*	*
Emmett RD	10	19.7	*	*	*	*	*	*	*	*	*	*
PAYETTE NF												
Council RD	12	6.6	23.2	0.7	1.9	7.4	21.2	5.1	6.7	38.2	43.3	*
Weiser RD	12	21.4	67.0	0.8	0.7	5.2	15.2	4.1	8.1	42.1	43.3	*
New Meadows RD	10	8.8	*	*	*	*	*	*	*	*	*	*
McCall RD	3	0.7	*	*	*	*	*	*	*	*	*	*
SALMON NF												
Northfork RD	*	*	0.4	0.6	21.3	2.9	6.6	*	1.9	38.7	11.4	*
SAWTOOTH NF												
Fairfield RD	5	70.5	80.3	16.5	3.3	13.3	19.7	0.0	6.3	20.3	5.2	1.6
OTHER												
Owyhee Mountains	4	76.1	75.5	12.8	15.8	7.8	9.4	0.6	10.8	*	*	55.8
Sharps Canyon	*	*	53.2	9.2	36.4	8.4	22.6	5.2	1.3	41.2	16.2	19.4
Pine Ridge-Lost Lake	1	25.0	*	*	*	*	*	*	*	*	*	*

* indicates no traps were deployed

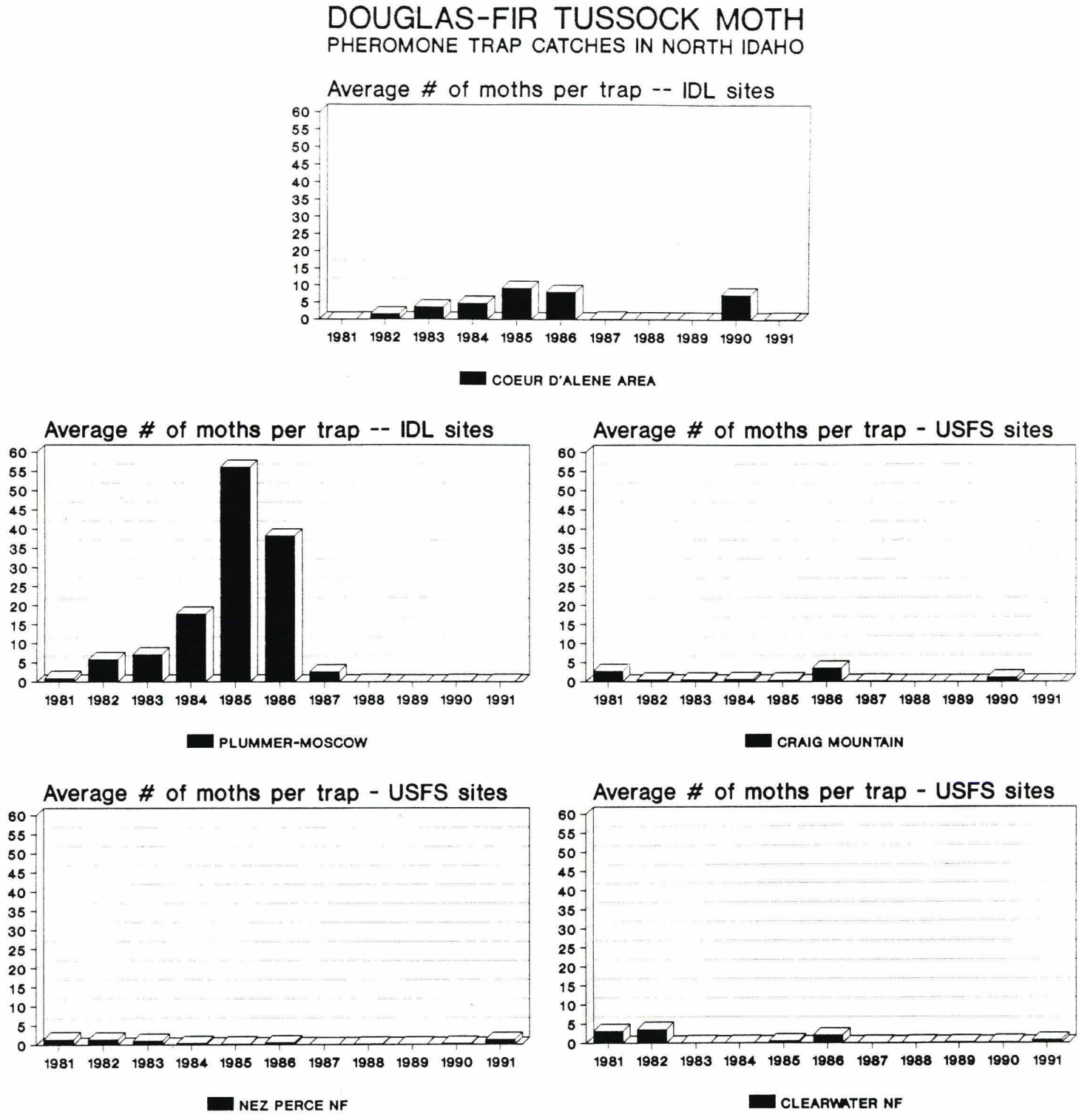


Figure 4. USFS and IDL
Douglas-fir Tussock Moth Trap Catches
in North Idaho 1981 - 1991

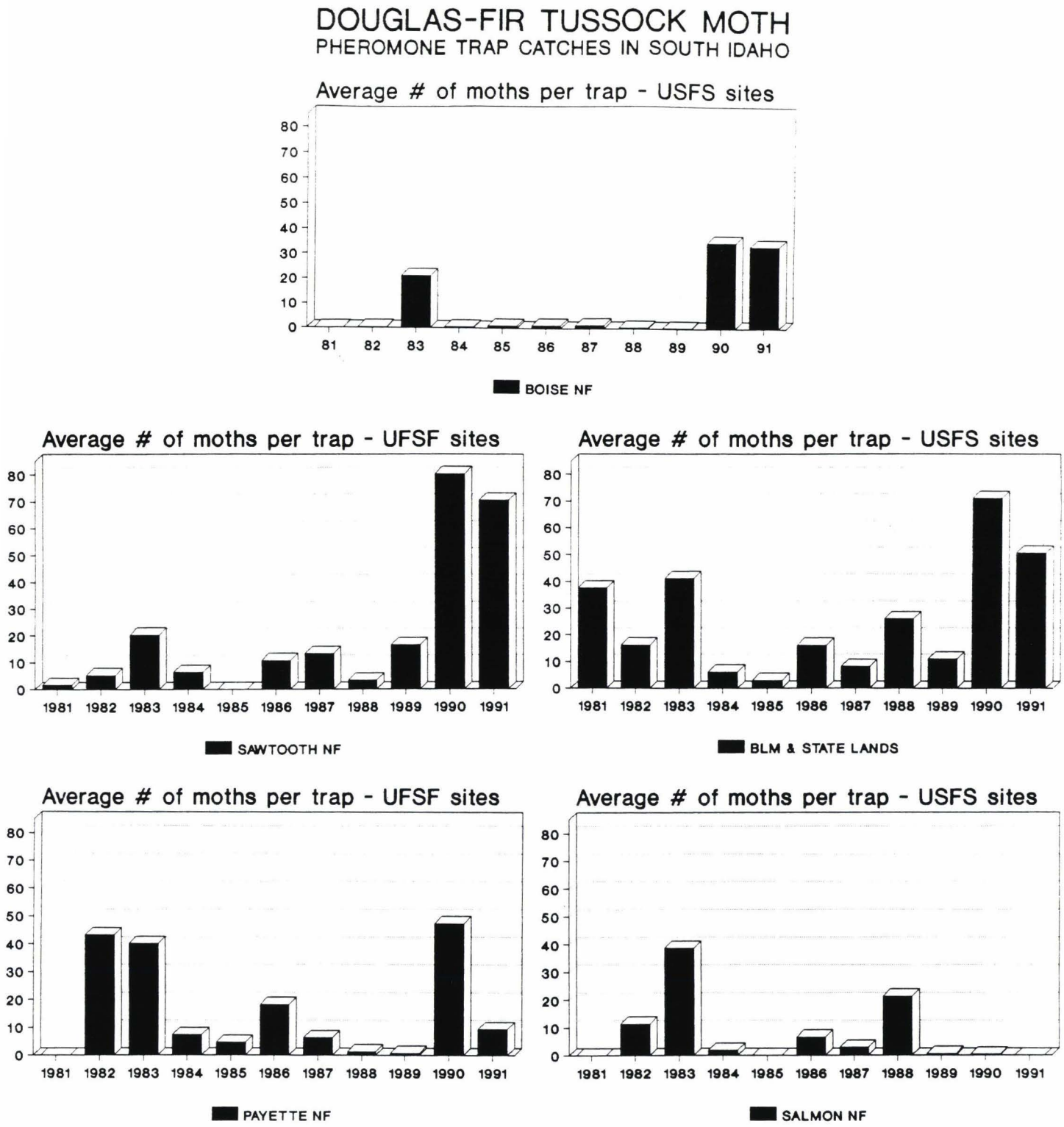

DOUGLAS-FIR TUSSOCK MOTH
PHEROMONE TRAP CATCHES IN SOUTH IDAHO
Average # of moths per trap - USFS sites
80
70
60
50
40
30
20
10
0
81 82 83 84 85 86 87 88 89 90 91
BOISE NF
Average # of moths per trap - UFSF sites
1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1991
SAWTOOTH NF
Average # of moths per trap - USFS sites
BLM & STATE LANDS
Average # of moths per trap - UFSF sites
PAYETTE NF
Average # of moths per trap - USFS sites
SALMON NF

Figure 5. USFS
Douglas-fir Tussock Moth Trap Catches
in Southern Idaho 1981 - 1991

GYPSY MOTH

In past years detection trapping was done in campgrounds, parks, and other tourist sites. In the late 1980's the emphasis shifted to grid trapping in urban areas where moths were apt to arrive with people moving in to the state from generally infested areas. Beginning in 1990 in northern Idaho and extending statewide in 1991, the program was expanded to cover rural areas. This was done because it was determined that many of the people that move to Idaho establish residence outside of the urban population centers. The survey areas will continue to expand as the rural/urban interface develops.

Detection trapping (4 traps / square mile): Detection trapping in 1991 produced four moths in widely separated areas of the state. One at Pinehurst, Shoshone County, 30 miles east of Coeur d'Alene, one at Moscow, Latah County, in north central Idaho, one at Wendell, Gooding County, in southern Idaho and one near the eastern edge of the state at Rigby, Jefferson County (Figure 7). We believe these catches to be incidental; however, more intensive delineation trapping will be done in the area surrounding these catch sites in 1992. The Idaho Department of Lands, the Idaho Department of Agriculture and the U.S. Forest Service Regions 1 and 4, with participation from the USDA Animal and Plant Health Inspection Service, cooperatively placed approximately 5,300 pheromone baited traps in the urban and rural areas of the state in 1991. Added emphasis is given to cities, towns and rural areas where sufficient moveins occurred to generate a moderate risk of introduction of gypsy moths.

Delineation trapping (36 traps / square mile): In 1990 six gypsy moths were caught in Idaho. Three were found in two widely separated traps in Idaho Falls, and three were caught in one trap in Dover, a small town three miles west of Sandpoint. In **1991** the areas surrounding these traps sites for one half mile to one mile were trapped at a trap density of 36 per square mile. No moths were caught in these areas this year.

Previous infestations: Eradication of previous infestations of gypsy moths in Sandpoint, Bonner County and in Coeur d'Alene, Kootenai county, has now been confirmed for two years. No moths were caught in the areas of concern neither in 1990 nor 1991 after treatments in 1989 and 1990 with the biological pesticide Bacillus thuringiensis.

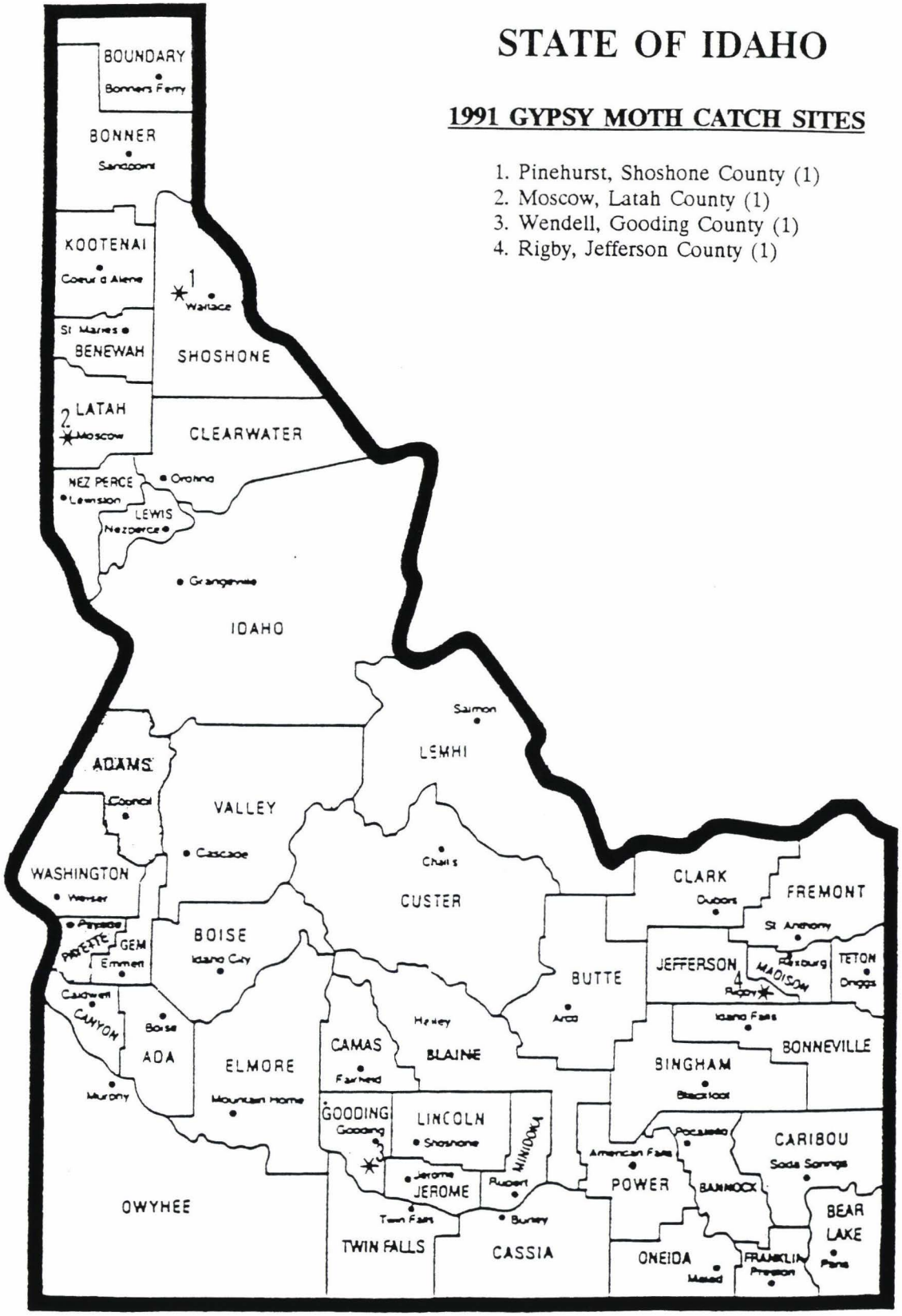
BOXELDER LEAFROLLER

Scattered boxelder trees along the Salmon River in the vicinity of Salmon Idaho were infested with this leafroller.

STATE OF IDAHO

1991 GYPSY MOTH CATCH SITES

1. Pinehurst, Shoshone County (1)
2. Moscow, Latah County (1)
3. Wendell, Gooding County (1)
4. Rigby, Jefferson County (1)



OTHER INSECTS

BALSAM WOOLLY ADELGID

Balsam woolly adelgid populations declined considerably in 1991 but may continue to pose a threat to true firs throughout northern Idaho. During the winter of 90/91, the severe weather conditions, where temperatures dropped as low as -29° Fahrenheit in some areas during December and January, may have contributed to the population decline the following field season. Tree mortality rate may fall again this year, but due to the extremely mild winter of 91/92, high adelgid populations may return.

Aerial surveys detected over 10,000 acres in 1991 as compared to 24,000 acres in 1990 of dead and fading subalpine fir. Numerous other areas have infested trees that are not yet showing symptoms from the air. Most of the damage is still occurring on the Clearwater and Nez Perce NF's and on adjacent state and private lands. Considerable mortality is still occurring on private lands in the Craig Mountains south of Lewiston and in the Joseph Plains area south of the Salmon River. Tree mortality continues to be confined to subalpine fir, although bole infestations are occurring on grand fir of all ages. The heavy gouting and killing is still prevalent on grand fir regeneration located adjacent to infested subalpine fir.

WESTERN PINE SHOOT BORER

Mating disruption treatment with artificial pheromone continued at the Tensed and Lone Mountain ponderosa pine test plantations. These areas will be treated again in 1992.

CRANBERRY GIRDLER MOTH

Cranberry girdler moths were caught in pheromone traps at the Coeur d'Alene nursery from May 29 through September 17. The peak catch of 929 moths occurred during the week of July 19-24, a week later than 1990. The nursery beds were sprayed with Diazinon, aimed at moths, on July 12 and August 5. Dursban, aimed at larvae in the soil, was applied on August 20. During the Fall 1991 and Spring 1992 lifting process, 10,640 seedlings were examined. Only 27 (.3%) were found damaged by girdler moth larvae.

CONE AND SEED INSECTS

The Moscow White Pine Arboretum was aerially sprayed with the insecticide Pydrin on May 16 to control cone and seed insects. Minimal damage was caused by the coneworm, cone moths and a cone feeding adelgid, during the summer. A total of 618 bushels of cones produced 205.3 pounds of seed in 1991 (.33 lb/bu).

The major pest at the Coeur d'Alene white pine seed orchard continues to be the western conifer seed bug. The orchard was sprayed July 17 with Pounce to control this pest. Full and half-strength concentrations were used and the resulting seed protection is being evaluated compared to unsprayed cones. Coneworms and adelgids were also detected during the summer. A total of 1037 bushels of cones were harvested yielding 131.8 pounds of seed. The low yield (.13 lb/bu) is thought to be due to insufficient pollen.

Lone Mountain mid- and high-elevation white pine seed orchards produced 140.25 bushels of cones and 4.4 pounds of seed (.03 lb/bu). Adelgids and very low levels of coneworms were detected throughout the summer and during cone harvest.

The white pine orchard at Grouse Creek produced 2.5 bushels of cones and 1.2 pounds of seed (.48 lb/bu). Twenty percent of the cones were infested in late summer with coneworms although infested cones were only partially destroyed. Adelgids were very common on the cones.

FOREST DISEASES

This narrative is divided into three sections. The first section describes unusual diseases or disease problems which have changed significantly during 1991. Our most severe disease problems continue to cause widespread damage over much of the same areas every year. Rough estimates indicate that root disease mortality occurs on nearly 2 millon acres of north Idaho forests, causing losses of over 30 million cubic feet. Estimates for dwarf mistletoe indicate over 700,000 acres are infected with volume losses of over 13 million cubic feet.

The second section is a table which summarizes all disease problems observed in 1991 with brief remarks describing hosts, location and severity.

The final section of the narrative briefly describes current projects dealing with root diseases, dwarf mistletoes, white pine blister rust, and nursery diseases.

STEM AND BRANCH DISEASES

DWARF MISTLETOES

Dwarf mistletoe management considerations are generally included in Forest plans, and emphasize management through conventional forest management practices. This is reducing the need for supplemental projects to sanitize previously harvested stands where infested trees remain and now threaten the new regeneration. Accomplishments for 1991 are reported in Table 6.

Table 6. - Dwarf Mistletoe Accomplishments - Southern Idaho 1991

National Forest	Presuppression	Treated Acres
Boise	515	
Caribou	233	
Challis	150	150
Payette	603	300
Salmon	223	
Sawtooth	200	
Total	1924	450

ROOT DISEASES

Root diseases continue to be the primary disease concern throughout northern Idaho forests and are the subject of several studies. Please refer to the project summaries in the following pages for the current status of these projects.

FOLIAGE DISEASES

In spite of a second very cool moist spring in northern Idaho, most needle diseases only showed moderate increases in severity. Larch needle diseases (Meria and Hypodermella) were appeared to be somewhat more intense than in 1990, especially in localized pockets in north Idaho where large trees were occasionally heavily infected.

Needle diseases on ponderosa pine in southern Idaho continued to decline while the Diplodia (Sphaeropsis) blight in northern Idaho continued to cause widespread dieback of small branches.

Needle diseases on white pine increased dramatically especially in stands in valleys where high moisture conditions prevailed.

VASCULAR WILTS

Dutch elm disease was detected for the first time in Lewiston on a single tree that was destroyed. An intensive monitoring and pruning program has been initiated to remove dead or wounded limbs.

The city of Boise suffered its worst losses in many years in 1991, having to remove over 60 infected elm trees. The total population is still nearly 1700 elms, but the city wants to avoid continued losses. They have budgeted over $9,000 to initiate a program to inject selected groups of elms with fungicides to prevent infection.

In Moscow, the city removed seven infected trees and the University removed an additional seven trees. The University is especially concerned about historic Camperdown elms, and has injected one infected tree in hopes of saving it. The city has also started an injection program for its largest group of elms in a city park where infected trees have been removed.

ABIOTIC DAMAGE

Unusual weather patterns or rapid changes in weather may result in "abiotic" damage. Damage can be widespread or very localized depending on the severity of the weather problem.

In southern Idaho, forests are exhibiting results of 5 consecutive years of below normal precipitation. Premature needle drop, leaf scorch, and seedling mortality were observed in many areas.

A localized late spring frost killed newly emerging foliage especially on larch in the Payette NF and vicinity.

STATUS OF CHRONIC DISEASE PROBLEMS

DISEASE	HOST	LOCATION/REMARKS
STEM & BRANCH DISEASES		
Aspen trunk rot	Aspen	Especially common in older aspen stands in southern Idaho.
Atropellis canker	Lodgepole pine	Found in pockets in pole sized stands causing defect, topkill, and some mortality.
Comandra blister rust	Lodgepole pine Ponderosa pine	Most common in SE Idaho; infrequent but may be locally severe.
Cytospora canker	Subalpine fir	Increased levels of symptoms, branch flagging, and mortality were observed in southern Idaho.
Diplodia blight (Sphaeropsis blight)	Ponderosa pine	Is causing widespread branch dieback in many Idaho areas; severity continues to increase in northern Idaho.
Dwarf mistletoe	Douglas fir, western larch, Lodgepole and ponderosa pine	Widespread and damaging throughout the state; see Table 6, for summary of suppression projects.
Indian paint fungus	True firs, hemlock	Causes 90% of decay in these species throughout the state; especially as age increases beyond 60 yrs.
Pinyon blister rust	Pinyon pine	Observed in the Raft River Mountains on the Sawtooth NF.
Red ring rot	Western larch, true firs, Douglas-fir, pines, spruce	Can cause serious decay problems in mature conifers.
Stalactiform rust	Lodgepole pine	Heavy infection has been observed in localized areas of the Salmon, Sawtooth, and Targhee National Forests.
Western gall rust	Lodgepole and ponderosa pine	Occurs throughout the host range; infection levels are highly variable.
White pine blister rust	Western white pine, limber pine, whitebark pine	Continues to be a major mortality factor in natural regeneration; is becoming a major problem in subalpine pines.

ROOT DISEASES

Annosus root disease	Pines, true firs, Douglas-fir, spruce	Causes mortality, root and butt rot especially in young trees near old stumps; frequently in complexes with other root diseases; may predispose trees to bark beetles.
Armillaria root disease	Douglas-fir, grand fir, other conifers especially when young	A widespread primary killer of Douglas-fir, true firs, or young trees of other species, especially if improperly planted.
Black stain root disease	Pines, Douglas-fir	Found infrequently in Idaho; usually in association with other root diseases.
Laminated root rot	Douglas-fir, true firs, occasionally other conifers	Primary killer in many stands from the Nez Perce north; may be found with Armillaria or other root diseases.
Schweinitizii root rot	Douglas-fir, pines	Common in mature and overmature forests throughout the state; frequently associated with other root diseases and bark beetles.
Tomentosus root disease	Douglas-fir, subalpine fir, Engelmann spruce	Commonly found with P. schweinitizii as a root/butt rot in southern Idaho; occasionally causes mortality.

FOLIAGE DISEASES

Conifer-Aspen rust Conifer-Cottonwood rust	Aspen, cottonwood, conifers	Commonly observed on hardwood hosts in southern Idaho; some clones were severely defoliated.
Rhabdocline needlecast	Douglas-fir	Very widespread but very light levels statewide; incidence decreased in 1991.
Swiss needlecast	Douglas-fir	Widespread in north Idaho; generally at very low levels of infection.
Elytroderma needlecast	Ponderosa pine	Widespread throughout the state but more prevalent in drier climates; levels continued to decline in 1991.
Fir broom rust	True firs	Widespread throughout the state; usually of little consequence but severity levels can vary substantially.
Fir needlecast	Subalpine fir Grand fir	Infection occurred at low levels throughout the host type.

Fir needle rust	Subalpine fir	Variable infection levels on young trees throughout host type; severe infections were observed in high elevations around McCall, Idaho.
Larch needlecast & blight	Larch	Both diseases occur throughout Idaho; detection in Southern Idaho was confounded by a severe late frost. In Northern Idaho there was an increase in localized areas of heavy infection.
Lodgepole pine needlecast	Lodgepole pine	Widespread throughout Idaho; infection levels were light in the south, but increased in the north in 1991.
Marssonina blight Shepard's Crook	Aspen	Scattered but increasing incidence of light to heavy intensity throughout most of host range.
Spruce broom rust	Engelmann spruce	Scattered through host range; most common in eastern Idaho.
White pine needlecast	Western white pine	Severe infections of lower crowns throughout north Idaho, especially near moist drainages.

NURSERY DISEASES

Cylindrocarpon	esp. white pine	Common in soil or contaminated containers, usually a saprophyte but may be a weak parasite.
Diplodia tip blight	esp. pines	Low levels in areas with a history of problems.
Fusarium root disease	Douglas-fir, larch, spruce, others	Very common nursery problem; may be carried on soil or containers.
Grey mold	most conifers, esp. larch, spruce,	Common at low levels in many nurseries.
Meria needlecast	larch	Infections levels were very low in 1991.
Phoma blight	most pines	Commonly isolated from seedlings and soil samples.
Sirococcus tip blight	spruce, pines	Found at low levels at several nurseries.

NURSERY - TREE IMPROVEMENT DISEASES

NEW AND UNUSUAL DISEASES

1. Douglas-fir seedling needle diseases

Rhabdocline pseudotsugae and R. weirii caused damage on planted Douglas-fir at the Bigfork Tree Improvement Site (Flathead NF). Damage was especially common on five and six year old trees; most damage was limited to the lower portions of tree crowns. Although much foliar discoloration and premature needle cast was evident in the spring, trees appeared mostly normal later in the year.

2. Inland cone rust

The Inland cone rust caused by Chrysomyxa pirolata, was identified on Engelmann spruce cones shipped to the Coeur d'Alene Nursery from the Kootenai and Clearwater NF's. This is the first report of the disease in Idaho. Damage was particularly severe on selected seedlots.

3. Pythium Root disease

Root disease caused by Pythium ultimum was located on container-grown Engelmann spruce, western white pine and ponderosa pine seedlings grown at the Plum Creek Nursery, Pablo, Montana. Water mold type diseases have been uncommon in container operations previously.

APPENDIX

SUMMARY OF FOREST PATHOLOGY PROJECTS

ANNOSUS ROOT DISEASE. An annosus root disease study has been completed on the Elk City and Clearwater Ranger Districts of the Nez Perce National Forest. Three pairs of stands consisting of a 10 to 30 year old clearcut and an adjacent uncut stand in the grand fir habitat series were examined intensively.

One study objective was to determine the relative importance of spore infection vs. vegetative (root-to-root) spread. The results from this study are somewhat mixed. Spore infections appear to play a major role in initiating new disease centers in both the clearcuts and the uncut stands. Vegetative spread is also present in both stands, but seems to be playing a minor role in disease spread. However, the role of vegetative spread may become more important as the regeneration continues to grow, increasing the chance of roots coming into contact with infected roots.

Another study objective was to determine which "strain" (intersterility group) was present on these sites. All samples collected were of the "S" strain which infects true firs, Engelmann spruce and Douglas-fir.

Since pines are not infected by this strain, future losses might be minimized by favoring or planting pines or other non-host species. Spore infections may be prevented by treating freshly cut stumps and avoiding injury to residual trees during stand entries.

ARMILLARIA/FERTILIZER STUDIES. Over 200 samples of decayed roots, Armillaria fans, and rhizomorphs are being analyzed by the Intermountain Research Station to determine "biological species" and clone distribution of Armillaria in 10 plots established near Grangemont in 1988-89. These plots received three different fertilizer treatments and are continuing to be monitored for differences that might be related to the treatments.

In a companion study, the University of Idaho has been applying similar fertilizer treatments to potted Douglas-fir seedlings. Each seedling has had a block of Armillaria-infected wood placed next to the root system. After 16 months, initial results indicate the fertilizer treatments are having significant impacts on tree growth and vigor, but no seedlings have exhibited any root disease symptoms.

ARMILLARIA ROOT DISEASE IN PONDEROSA PINE PLANTATIONS. A cooperative study with the IDL and University of Idaho has been initiated to evaluate root disease losses in ponderosa pine plantations. Previous surveys on IDL plantations on the Rathdrum Prairie found annual mortality rates of 1-2% and mortality seemed to be strongly associated with improperly planted trees.

During the summer of 1991, five plantations were surveyed and thirty-three plots were established to monitor losses and examine relationships between Armillaria and root structure, growth rates, and tree nutrition. Surveys found losses of 3-11% on these ten-year old plantations, and initial observations found root systems in plantations from containerized trees were more poorly formed than those established with bareroot stock. Foliage samples were collected from all plot trees and will be analyzed to evaluate nutrient changes in relation to root disease symptoms and mortality.

COEUR D'ALENE BASIN ROOT DISEASE PROJECT. Preliminary survey results indicate that about 35% of the Coeur d'Alene Basin is impacted by root disease (238,000 of 732,000 acres), and that 62% (nearly 14,000 acres) are so severely impacted that they will require rehabilitation to return them to timber production. Growth projections for many of these sites indicate yields will be far less than the Forest Plan estimates.
Data analysis is continuing and an interdisciplinary team has been put together to establish a framework for predicting root disease impacts on a site specific and landscape basis.

ROOT DISEASE MODEL UPDATE. The model is continuing to be used and improved. Local access through the Forest Service Data General system is continuing to improve but some program defaults may still need to be changed to produce realistic values for this Region. Contact Sue Hagle to obtain a file of parameters needed or for other questions about running the root disease model.

WESTERN LARCH DWARF MISTLETOE PERMANENT PLOTS. A permanent plot study was initiated in the Valley Creek area on the southern end of the Flathead Indian Reservation that was selectively harvested in the mid-1970's. The existing stand is a mature western larch overstory with a well-stocked understory of 10-25 feet tall western larch saplings and scattered, smaller grand firs, sub-alpine firs, spruce, and western redcedars. The overstory is heavily infected with larch dwarf mistletoe with most trees exhibiting extensive brooming. The understory is lightly infected with dwarf mistletoe; infected trees are scattered throughout the stand, and in those trees infected, infections are largely limited to the lower third of the crown.

This study has four main objectives: 1) to quantify the spread and intensification of dwarf mistletoe in western larch with and without overstory removal and precommercial thinning, 2) to quantify the growth effects due to dwarf mistletoe in infected western larch with and without overstory removal and precommercial thinning, 3) to provide a visual demonstration of the treatment effects on stand growth and development, and 4) to provide data for the validation of dwarf mistletoe models for stand conditions similar to those found in this study.

DOUGLAS-FIR DWARF MISTLETOE PERMANENT PLOTS. Ten new permanent plots were installed as part of the west-wide project to establish a database to validate and calibrate the dwarf mistletoe model. The permanent inventory plot system from two national forests were also evaluated for potential use.

DWARF MISTLETOE MODEL. A new and improved PROGNOSIS-linked dwarf mistletoe model is available for operational use. The improvements to this model include linkage to all PROGNOSIS variants (previously, the model was not linked to the Inland Empire variant), functions which account for mortality due to dwarf mistletoe, and a new set of keywords which give the user better simulation capabilities. The dwarf mistletoe model will run from PROGNOSIS automatically, but users need to make sure they have the most recently updated copy of the executable program. Contact Jane Taylor with any questions about using the dwarf mistletoe model.

DWARF MISTLETOE INFECTION OF YOUNG WESTERN LARCH. A study was began on Idaho state lands to determine the approximate ages and heights at which young western larch are initially infected by larch dwarf mistletoe. One hundred infected larch saplings were examined in 1991 and their age and height when first infected were determined by aging all mistletoe infections on each sapling. Several temporary plots will be established around mistletoe-infected seed trees in 1992. Infection of young regeneration near the infected seed trees will be monitored for several years.

WHITE PINE BLISTER RUST. OLD PRUNING/THINNING PLOTS

During 1991, five white pine plantations that had received pruning and thinning treatments over 20 years ago were re-visited. A total of 48 one-quarter acre plots were remeasured for growth, mortality, and blister rust infection.

Although the data has not yet been fully analyzed, it appears that blister rust mortality was much greater in unthinned control plots and plots that were thinned only in comparison to plots where thinning had been combined with pruning of all crop trees or only the white pine (Fig 7). This tends to support findings from remeasurements in 1974 and 1979 that indicated infection rates were higher in the thinned only and control plots.

RUST STATUS SURVEYS. A new project was initiated to monitor blister rust infection in rust-resistant white pine plantations on Idaho state lands. Data on infection rates and rust hazard conditions in and around white pine plantations was collected. Four plantations were sampled during 1991. The project will continue in 1992.

BLISTER RUST MODEL. A PROGNOSIS-linked model to predict blister rust impact is being developed in cooperation with the Method Applications Group (MAG) in Ft. Collins, Colorado. It is based on extensive research by Geral McDonald and others who participated in a facilitated workshop in February of 1991. Data collected
during 1991 is currently being analyzed to help validate and calibrate the model for testing.

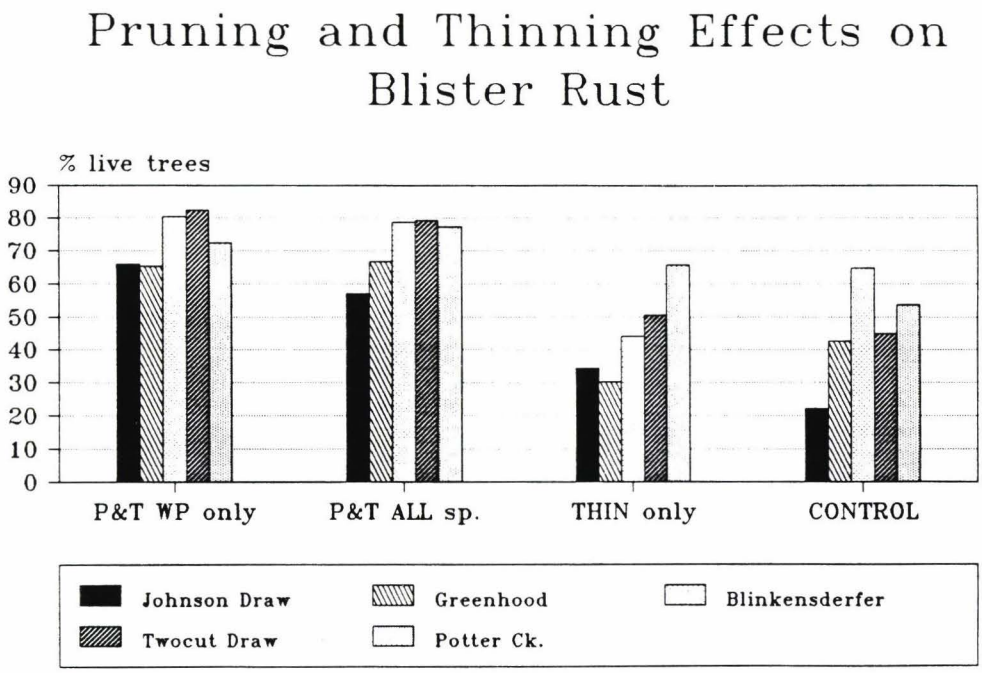


Figure 7. % of live White Pine trees
20 years after
pruning and thinning treatments

SUMMARY OF NURSERY DISEASE PROJECTS

1. Biological control of Fusarium oxysporum by Trichoderma harzianum (in cooperation with the University of Idaho). Isolates of T. harzianum developed for their biocontrol potential on agricultural crops are being tested against the common nursery pathogen Fusarium oxysporum.

2. Evaluation of various formulations of peat-vermiculite growing media on root pathogens of container-grown seedlings (in cooperation with the USDA Forest Service Nursery, Coeur d'Alene). Work has been completed and data analysis is underway.

3. Pathogenic characteristics of Cylindrocarpon spp. on container-grown Douglas-fir seedlings (in cooperation with the University of Idaho). Damping-off and seedling establishment/growth tests will be conducted to evaluate pathogenic behavior of selected isolates of C. destructans and C. tenue, common rhizosphere inhabitants of conifer seedlings.

4. Efficacy of Mycostop® biofungicide to control Fusarium root disease of container-grown Douglas-fir seedlings (in cooperation with the University of Idaho). This is a formulation of Streptomyces griseoviridis which will be evaluated as a seed dressing and in topical applications.

5. Vectoring of fungi by greenhouse-inhabiting fungus gnats in container seedling operations (in cooperation with the University of Idaho). This evaluation will identify and characterize fungi vectored by gnats that feed within containers.

6. Pathogenic potential of Fusarium spp. associated with conifer seedling diseases. Rapid, repeatable techniques will be developed to screen large numbers of Fusarium isolates which are routinely isolated from seedlings for their ability to elicit disease. These techniques will help elucidate host ranges and variation in pathogenic behavior of selected Fusarium species.

7. Evaluate efficacy of hot water and alternative treatments of containers to reduce impact of root disease in container operations. This continuing project is designed to develop techniques whereby growers can reduce carryover of pathogen inoculum on containers, thus reducing potential damage to future crops of seedlings when containers are reused.

SUMMARY OF FOREST ENTOMOLOGY PROJECTS

Field Test of TM BioControl-1. A rate test of TM BioControl-1 was conducted on the Boise NF near Featherville, Idaho during 1991. Aerial applications were completed during early July. Coverage appears to be satisfactory. Preliminary results are not encouraging.

Douglas-fir Tussock Moth Mating Disruption Pilot Test. This test was intended to demonstrate the feasibility of using a mating disruption technique as an operational suppression tactic. Pheromone loaded in fibers and mixed with a sticker was applied via helicopter to 600 acres in the Manns Creek drainage on the Weiser Ranger District, Payette NF. Preliminary results are encouraging.

Special Research Project to Evaluate Mountain Pine Beetle Response to Different Verbenone Dosages in Lodgepole Pine Stands. A cooperative field test of various rates of verbenone, a bark beetle antiaggregative semiochemical, was installed by personnel from Forest Pest Management and the Intermountain Research Station during 1991 in the Sawtooth National Recreation Area. This test was designed to determine an optimum treatment rate to prevent mountain pine beetle infestations in lodgepole pine stands. Treatment rates of 20 and 40 verbenone bubble caps per acre were deployed. Results were not encouraging.

Semiochemical Baiting for Spruce Beetle. Data analysis is currently being conducted. Preliminary results indicate that the average number of infested trees between treatments, two baits per acre versus five baits per acre, differ significantly.

Semiochemical Baiting Efficiency for Western Pine Beetle. This project attempted to show differences exist for semiochemical baiting densities for western pine beetle. One acre plots were treated with 0, 2, or 5 baits and beetle attack was evaluated. Beetle populations in the project area were too low to measure effect.

Evaluation of a Semiochemical Pine Engraver Beetle Repellent. This cooperative project tested the effects of a mixture of verbenone and ipsenol to prevent pine engraver beetle infestation of ponderosa pine slash. Less slash was infested on the treated plots and attack density was significantly reduced. This project was replicated in eastern Montana, and southern and northern Idaho.

Evaluation of the Duration and Periodicity of Pine Engraver Beetle Flight. Flight was monitored using Lindgren funnel traps baited with pheromone attractants. In addition to the Ips beetles, many other insects associated with dead and dying wood were also caught in the traps.

A Field Test of the Efficacy of MCH in Preventing Douglas Beetle Infestation in Douglas-fir. This completed project attempted to test the influence of MCH on tree infestation by Douglas-fir beetle. Beetle populations in the study area were too low for measurable results.

Evaluation of Global Positioning Systems for Gypsy Moth Detection Surveys. Successful trap retrieval was affected by locational variability caused by topography, vegetative cover, satellite array, selective availability and user proficiency. Two years of data has been analyzed and a draft report is in progress. A manuscript will be submitted to the Methods Application Group for publication.

Data Visualization of Forest Management Issues on the Dixie National Forest.
Insect damage and management alternative scenarios with expected impacts are being developed for four sites on the Dixie NF in Utah. Visual simulations will be developed for various times from immediate post management to sixty years from initial infestation. This process will initiate development of a public perception model addressing insect impacts and management responses.

Permanent Plots to Validate the Dwarf Mistletoe Extension of PROGNOSIS MODEL. The purpose of this ongoing, westwide project is establish a database to validate and calibrate the dwarf mistletoe model linked to the PROGNOSIS model for stand development. Ten new permanent plots were installed and the permanent inventory plot system from two national forests were evaluated.

Validation Project for Mountain Pine Beetle Extension of PROGNOSIS MODEL. Validation and statistical analysis have been completed on data from thirty-five stands on the Ashley and Wasatch-Cache NF's. Field data following a mountain pine beetle outbreak was compared to PROGNOSIS predictions. Statistically, the model failed to significantly project tree losses for smaller sized classes of lodgepole pine in the study area. A manuscript is being submitted for a Methods Application Group publication.

Western spruce budworm pheromone trap evaluation. A study to correlate the number of adult moths caught in pheromone traps with egg mass and larval densities and resulting defoliation continued for the third year. Once a good correlation is obtained, the use of pheromone traps will provide an easier, more efficient budworm population assessment than the time consuming larval and egg mass samples.

Western spruce budworm permanent plots. Permanent plots were installed on the Nez perce NF in northern Idaho and on several forest in Montana. These plots are part of a westwide project to validate and calibrate the Western spruce Bubworm Extension of the PROGNOSIS model.

COMMON AND SCIENTIFIC NAMES OF INSECTS

Balsam woolly adelgid	*Adelges picea* (Ratzburg)
Boxelder leafroller	*Caloptilia negundella* (Chambers)
Cone feeding adelgid	*Pineus coloradensis* (Gillette)
Cone moth	*Eucosma recissoriana* Heinrich
Cone worms	*Dioryctria* sp.
Cranberry girdler moth	*Chrysoteuchia topiaria* (Zeller)
Douglas-fir beetle	*Dendroctonus pseudotsugae* Hopk.
Douglas-fir tussock moth	*Orgyia pseudotsugata* McDunnough
Fir engraver	*Scolytus ventralis* LeConte
Gypsy moth	*Lymantria dispar* (L.)
Mountain pine beetle	*Dendroctonus ponderosae* Hopk.
Pine engraver	*Ips pini* (Say)
Silver fir beetle	*Pseudohyesinus sericeus*
Spruce beetle	*Dendroctonus rufipennis* (Kirby)
Western balsam bark beetle	*Dryocoetes confusus* Swaine
Western conifer seedbug	*Leptoglossus occidentalis* Heidmann
Western pine beetle	*Dendroctonus brevicomis* LeConte
Western pine shootborer	*Eucosma sonomana* Kearfott
Western spruce budworm	*Choristoneura occidentalis* Freeman

COMMON AND SCIENTIFIC NAMES OF DISEASES

Annosus root disease	*Heterobasidion annosum* (Fr.) Bref.
Armillaria root disease	*Armillaria ostoyae* (Romagn.) Herink
Aspen trunk rot	*Phellinus tremulae* (Bond.) Bond. & Boriss
Atropellis canker	*Atropellis piniphila* (Weir) L. & H.
Black stain root disease	*Leptographium wagneri* (Kendr.) Wingf.
Brown cubical butt rot	*Phaeolus schweinitzii* (Fr.) Pat.
Comandra blister rust	*Cronartium comandrae* Pk.
Conifer-Aspen rust	*Melampsora medusae* Thum.
Cylindrocarpon root disease	*Cylindrocarpon* spp.
Cytospora canker of firs	*Cytospora abietis* Sacc.
Diplodia tip blight	*Sphaeropsis sapinea* (Fr.) Dyko
Dutch elm disease	*Ceratocystis ulmi* (Buism.) C. Mor.
Dwarf mistletoes	*Arceuthobium* spp.
Elytroderma needle cast	*Elytroderma deformans* (Weir) Dark.
Fir broom rust	*Melampsorella caryophyllacearum* Schroet.
Fir needle cast	*Lirula abietis-concoloris* (Mayr:Dearn) Darker
Fir needle rust	*Pucciniastrum epilobii* Otth
Fusarium root disease	*Fusarium* spp.
Grey mold	*Botrytis cinerea* Pers. ex Fr.
Indian paint fungus	*Echinodontium tinctorium* (Ell.& Ev.) Ell. & Ev.
Inland cone rust	*Chrysomyxa pirolata* Wint.
Laminated root rot	*Phellinus weirii* (Murr.) Gilb.
Larch needle blight	*Hypodermella laricis* Tub.
Larch needle cast	*Meria laricis* Vuill.
Lodgepole pine needle cast	*Lophodermella concolor* (Dearn.) Dark.
Marssonina leaf spot	*Marssonina populi* (Lib.) Magn.
Phoma blight	*Phoma* spp.
Pinyon blister rust	*Cronartium occidentale* Mein.

Pythium root disease	*Pythium ultimum* Trow.
Red ring rot	*Phellinus pini* Pilat.
Rhabdocline needle cast	*Rhabdocline pseudotsugae* Syd. *Rhabdocline weirii* Parker & Reid
Shepard's crook	*Venturia macularis* (Fr.) E.Muller & Von Arx
Sirococcus tip blight	*Sirococcus strobilinus* Preuss.
Stalactiform rust	*Cronartium coleosporioides* (Diet. & Holw.) Arth.
Spruce broom rust	*Chrysomyxa arctostaphyli* Diet.
Swiss needle cast	*Phaeocryptopus gaeumannii* (Rhode) Pet.
Tomentosus root disease	*Inonotus tomentosus* (Fr.) Gilb.
Western gall rust	*Endocronartium harknessii* (Moore) Hir
White pine blister rust	*Cronartium ribicola* Fisch.
White pine needlecast	*Lophodermella arcuata* (Darker) Darker

RECENT PUBLICATIONS

Amman, G., R.W. Thier, J.C. Weatherby, L. Rasmussen, A.S. Munson. 1991. Optimum dosage of verbenone to reduce infestation of mountain pine beetle in lodgepole pine stands of central Idaho.

Byler, J.W., S. Zimmer-Grove. 1991. A forest health perspective on interior Douglas-fir management. In: Interior Douglas-fir, the species and its management. Symposium at Spokane, Wa. Feb 27-Mar 1, 1990.

Dumroese, R. K., R. L. James and D. L. Wenny. 1990. Trial of a granular etridiazole and ophanate methyl mixture to control Fusarium root disease of container-grown Douglas-fir seedlings. New Forests 4:231-236.

Edminster, C. B, R. L. Mathiasen, and W. K. Olsen. 1991. A method for constructing site index curves from height-age measurements applied to Douglas-fir in the Southwest. USDA Forest Service Research Note RM-510, 6p.

Edminster, C. B., H. T. Mowrer, R. L. Mathiasen, T. M. Schuler, W. K. Olsen, and F. G. Hawksworth. 1991. GENGYM: A variable density stand table projection system calibrated for mixed conifer and ponderosa pine stands in the Southwest. USDA Forest Service Research Paper RM-297, 32 p.

Hoffman, J.T., L. Speigel. (compilers) 1990. Proceedings of the thirty-eighth annual western international forest disease work conference. Days Conference Center, Redding, Ca. Sept 17-21. 157p.

Filip, G.M. and J.T. Hoffman. 1991. Root disease management in western-montane forest soils. In: Proceedings of Symposium on management and productivity of western-montane forest soils. USDA Forest Service, Intermountain Research Station, Moscow, Id. General Tech. Rpt., INT-280, 254p.

Gast, S.J. 1992. Cone and seed insect surveys in North Idaho western white pine seed orchards- 1991. USDA Forest Service, Northern Region, Timber, Cooperative Forestry and Pest Management. Rept. 92-6, 6p.

James, R. L. 1991. Cylindrocarpon root disease of container-grown whitebark pine seedlings - USDA Forest Service Nursery, Coeur d'Alene, Idaho. USDA Forest Service, Northern Region, Timber, Cooperative Forestry and Pest Management. Rept. 91-8. 10p.

James, R. L., W. Antrobius and C. J. Gilligan. 1991. Dwarfing of bareroot western larch seedlings - USDA Forest Service Nursery, Coeur d'Alene, Idaho. USDA Forest Service, Northern Region, Timber, Cooperative Forestry and Pest Management. Rept. 91-7. 14p.

James, R. L., R. L. Mathiasen and J. W. Schwandt. 1991. Sphaeropsis blight of ponderosa pine in northern Idaho. USDA Forest Service, Northern Region, Timber, Cooperative Forestry and Pest Management. Rept. 91-10. 8p.

Knapp, K.A., J.C. Weatherby, J.T. Hoffman, D.E. Hansen, L.A. LaMadeleine, R.E. Williams. 1991. Forest Insect and Disease Conditions, Intermountain Region 1990. USDA Forest Service, Intermountain Region, FPM report. 33p.

Livingston, R. L. 1991. Gypsy moth: A major pest of trees. Idaho Dept. of Lands, State Forester Forum, Forest Pest No. 5, 4 p.

Livingston, R. L. 1991. Mountain pine beetle. Idaho Dept. of Lands, State Forester Forum, Forest Pest No. 6, 4 p.

Livingston, R. L. 1991. Western pine beetle. Idaho Dept. of Lands, State Forester Forum, Forest Pest No. 7, 4 p.

Livingston, R. L. and D.P. Beckman. 1991. Spruce beetle and Douglas-fir beetle survey with management recommendations for the Payette Lakes administrative area. Idaho Dept. of Lands Report No.: IDL 91-3, 26 p.

Mason, L. and R. L. Livingston. 1991. State of Idaho gypsy moth survey trapping program summary report, 1991. Idaho Dept. of Lands Report No. 91-4. 7 p.

Mathiasen, R. L. 1991. Laminated root disease. Idaho Dept. of Lands, State Forester Form, Forest Pest No. 2, 4 p.

Mathiasen, R. L. 1991. Armillaria root disease. Idaho Dept. of Lands, State Forester Forum, Forest Pest No. 3, 4 p.

Mathiasen, R. L. 1991. Dwarf mistletoes. Idaho Dept. of Lands, State Forester Forum, Forest Pest No. 4, 4 p.

Mathiasen, R. L. 1991. Annosus root disease. Idaho Dept. of Lands, State Forester Forum, Forest Pest No. 8, 4 p.

Mathiasen, R. L. 1991. Important stem decays in Idaho. Idaho Dept. of Lands, State Forester Forum, Forest Pest No. 9, 3 p.

Mathiasen, R. L. 1991. Broom rusts in Idaho. Idaho Dept. of Lands, State Forester Forum, Forest Pest No. 10, 2 p.

Mathiasen, R. L. 1991. Elytroderma disease. Idaho Dept. of Lands, State Forester Forum, Forest Pest No. 11, 2 p.

Mathiasen, R. L. 1991. Common needle diseases in Idaho. Idaho Dept. of Lands, State Forester Forum, Forest Pest No. 12, 3 p.

Mathiasen, R. L. 1991. Western gall rust. Idaho Dept. of Lands, State Forester Forum, Forest Pest No. 13, 2 p.

Mathiasen, R. L. 1991. White pine blister rust in Idaho. Idaho Dept. of Lands, State Forester Forum, Forest Pest No. 14, 4 p.

Mocettini, P. 1991. Spruce beetle population trend on the Payette National Forest, Idaho. USDA Forest Service, Intermountain Region, FPM Report. 5p.

Munson, A.S. 1991. Utah gypsy moth eradication program. 1990 report. Tree Leaves. Vol.15 No.2. 3p.

1991 Nursery Disease Notes (Northern Region: Timber, Cooperative Forestry and Pest Management):

No. 115 Colonization of Engelmann spruce and lodgepole pine seed with Mortierella spp. - USDA Forest Service Nursery, Coeur d'Alene, Idaho. 7p.

No. 116 Root decay of container-grown lodgepole pine and western white pine seedlings - USDA Forest Service Nursery, Coeur d'Alene, Idaho. 4p.

No. 117 Outbreak of Lophodermella needle cast on lodgepole pine within the Condon Tree Improvement Plantation, Montana. 3p.

No. 118 Meria needle cast on bareroot 2-0 seedlings and young tree improvement plantation trees - USDA Forest Service Nursery, Coeur d'Alene, Idaho. 3p.

No. 119. Armillaria root disease at the Yaak-Kilbrennan Tree Improvement Plantation - Three Rivers Ranger District, Kootenai National Forest, Montana. 3p.

No. 120. Fungal colonization of roots from western white pine transplant seedlings outplanted on the Wallace Ranger District, Idaho Panhandle National Forests, Idaho. 10p.

No. 121. Basal swelling and root deterioration of container-grown western larch seedlings - Plum Creek Nursery. Pablo, Montana. 8p.

No. 122. Dieback and wilt of caragana seedlings - Montana State Nursery, Missoula. 6p.

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Oakes, R. D., and K. E. Gibson. 1991. Bark beetle conditions Northern Region 1990. USDA, Forest Service, Timber, Cooperative Forestry and Pest Management Rept.91-06, 37p.

Parks, C. and J.T. Hoffman. 1991. Control of western dwarf mistletoe with the plant-growth regulator Ethephon. USDA Forest Service, Pacific Northwest Research Station, LaGrande, Ore. Research Note, PNW-RN-506, 4p.

Thier, R.W. and J.C. Weatherby. 1991. Mortality of Douglas-fir after two semiochemical baiting treatments for Douglas-fir beetle. (Coleoptera:Scolytidea). J. Econ. Ent. 84(3):962-964.

USDA Forest Service, Intermountain Research Station, Res. Paper INT-446, 5p. Beckman, D.P., S.J.Gast, J.W. Schwandt, R.L. James, R.L. Livingston, K.A. Knapp, J.C. Weatherby, J.T. Hoffman, R.E. Williams. 1991. Idaho Forest Pest Conditions and Program Summary- 1990. Idaho Department of Lands, USDA Forest Service, Northern and Intermountain Regions, Report No. 91-2, 36p.

Weatherby, J.C. and D.Cahill. 1990. Western spruce budworm silvicultural demonstration area, Payette National Forest. USDA Forest Service, Intermountain Region, FPM Report 12p.

Weatherby, J.C., K.A. Knapp, B. Gardner. 1991. A biological evaluation of the Douglas-fir tussock moth outbreak in southern Idaho, 1990. USDA Forest Service, Intermountain Region, FPM Report. 18p.

Weatherby, J.C. 1991. Mechanical methods and chemical control. In: Proceedings of the Workshop on Exotic Aphid Pests of Conifers: A crisis in African Forestry. Kenya Forestry Research Institute, Muguga, Kenya. 117-120.

DOUGLAS-FIR BEETLE
WESTERN PINE BEETLE
PINE ENGRAVER BEETLE
MOUNTAIN PINE BEETLE
BALSAM WOOLLY ADELGID

1991

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

STATE OF IDAHO

Scale 1:1,000,000
1 inch equals approximately 16 miles

Datum is mean sea level

Compiled, edited, and published by the Geological Survey
North American datum
Lambert conformal conic projection based on standard parallels 33° and 45°

LEGEND

- State capital
- County seat
- City, town, village or locality
- Selected cultural feature

SOURCE DATA

BASE MAP

POPULATION KEY

BOISE	more than 25,000
TWIN FALLS	10,000 to 25,000
Kellogg	2,500 to 10,000
Shoshone	1,000 to 2,500
Hailey	less than 1,000

Boundaries accurate to scale shown

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DOUGLAS-FIR TUSSOCK MOTH
FIR ENGRAVER BEETLE
SPRUCE BEETLE
WESTERN SPRUCE BUDWORM
BALSAM BARK BEETLE

1991

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

STATE OF IDAHO

Scale 1:1,000,000
1 inch equals approximately 16 miles

Datum is mean sea level

BASE MAP

POPULATION KEY
BOISE more than 25,000
TWIN FALLS 10,000 to 25,000
Kellogg 2,500 to 10,000
Stanley 1,000 to 2,500
less than 1,000

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